

Application No. 09/786,338
Attorney Docket No. 107400-00023

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IN THE SPECIFICATION

On page 11, please replace the paragraph beginning at line 18 with the following:

--A method of narrowing a band gap of a ZnO compound semiconductor according to an embodiment of the invention of claim 10 aims at reducing the band gap of ZnO by forming a solid solution of CdO and ZnO to make a mixed crystal having a general formula represented by $Cd_xZn_{1-x}O$ ($0 \leq x \leq 1$).--

On page 13, please replace the paragraph beginning at line 12 with the following:

--A semiconductor laser according to the invention of claim ~~[[13]]~~ 12 has an active layer that emits light by electric current injection and n-type and p-type cladding layers made of materials having a larger band gap than the active layer and sandwiching the active layer from both sides thereof, wherein the active layer is made of a quantum well structure constructed with a composition modification of $Cd_xZn_{1-x}O$ ($0 \leq x \leq 1$), and a stress-alleviating layer is disposed on at least one side of the n-type cladding layer side and the p-type cladding layer side of the active layer so as to be in contact with the active layer, the stress-alleviating layer being made of $Mg_wZn_{1-w}O$ ($0 \leq w \leq 1$) having a composition with approximately the same lattice constant as the composition located on the outermost side of the active layer of the at least one side.--

On page 15, please replace the paragraph beginning with line 5 with the following:

--A method of manufacturing a ZnO-based compound semiconductor light emitting device according to an embodiment of the present invention claim 17 is a

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method of manufacturing a ZnO-based compound semiconductor light emitting device in which an active layer is made of a ZnO-based compound semiconductor containing Cd is sandwiched between cladding layers made of ZnO-based compound semiconductor, comprising the steps of growing the active layer made of the ZnO-based compound semiconductor containing Cd, growing a Cd-evaporation-preventing layer made of ZnO at approximately the same low temperature as the growth temperature of the active layer, and then a ZnO-based compound semiconductor layer is grown at a high temperature.--

On page 15, please replace the paragraph beginning at line 18 with the following:

--A semiconductor light emitting device according to claim ~~[[18]]~~ 16 comprises a sapphire substrate, a buffer layer made of an Al₂O₃ film disposed on the sapphire substrate, and a light emitting layer forming portion made of AnO-based compound semiconductor disposed on the buffer layer, the light emitting layer forming portion including at least n-type and p-type layers to form a light emitting layer.--

On page 17, please replace the paragraph beginning at line 7 with the following:

--A method of manufacturing a semiconductor light emitting device according to an embodiment of the present invention claim ~~20~~ comprises the steps of depositing an Al₂O₃ film at a low temperature on a sapphire substrate, ~~rasing~~ raising the temperature of the sapphire substrate to a temperature such that single crystals can be grown, and growing a light emitting layer forming portion which is made of ZnO-based compound

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semiconductor and comprises a first conductivity layer and a second conductivity layer to form a light emitting layer.--

Please replace the paragraph beginning on page 17, line 27 and ending on page 18, line 9, with the following:

--A semiconductor light emitting device according to claim ~~[[21]]~~ 18 comprises a substrate, and a semiconductor laminate section disposed on the substrate and made of oxide compound semiconductor layers and including a light emitting layer forming portion, wherein an oxide thin film containing Zn is disposed as a buffer layer on a front surface of the substrate at a lower temperature than the temperature of growing the semiconductor layers of the semiconductor laminate section and is interposed between the substrate and the semiconductor laminate section.--

On page 19, please replace the paragraph beginning at line 8 with the following:

--A method of manufacturing a semiconductor light emitting device according to claim ~~[[23]]~~ 20 comprises the steps of, forming a non-crystalline or polycrystalline oxide thin film containing Zn on a substrate by a sputtering method, a vacuum vapor deposition method, or a laser ablation method, putting the substrate into an apparatus for epitaxial growth of semiconductor layers and raising a substrate temperature to a growth temperature, and laminating an oxide compound semiconductor layer to form a light emitting layer forming portion.--

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On page 20, please replace the paragraph beginning at line 14 with the following:

--A semiconductor light emitting device according to the invention of claim [[24]] 21 comprises a substrate, and a semiconductor laminate section including a light emitting layer forming portion made of compound semiconductor layers disposed on the substrate and having n-type and p-type layers to form a light emitting layer, wherein a buffer layer is disposed between the substrate and the semiconductor laminate section, the buffer layer being made of a material having a thermal expansion coefficient larger than the thermal expansion coefficient of an epitaxial growth layer at the lowermost layer of the semiconductor laminate section and smaller than the thermal expansion coefficient of the substrate.--

On page 22, please replace the paragraph beginning at line 15 with the following:

--A semiconductor light emitting device according to claim [[27]] 24 comprises a substrate, a reflective film for reflecting light from a front surface side of the substrate, and a semiconductor laminate section, wherein the reflective film is laminated by an even number of dielectric films or semiconductor films having different refractive indices with a thickness of $\lambda/(4n)$ (n is a refractive index of the dielectric film or the semiconductor film, and λ is a light emission wavelength) on the substrate so that a layer having a smaller refractive index and a layer having a larger refractive index are alternatively laminated in this order, and wherein in the semiconductor laminate section in which semiconductor layers are laminated on the reflective film to form a light emitting layer.--

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On page 24, please replace the paragraph beginning at line 4 with the following:

--A ZnO-based compound semiconductor light emitting device according to claim
[[30]] 27 is a ZnO-based compound semiconductor light emitting device comprising a
substrate, and a light emitting layer forming portion disposed on the substrate and
forming a light emitting layer by lamination of ZnO-based compound semiconductor
having at least an n-type layer, wherein an n-side electrode disposed in contact with the
n-type layer of the ZnO-based compound semiconductor is formed so that a portion of
the n-side electrode which is in contact with the n-type layer is formed of Ti or Cr, the
portion not containing Al.--

On page 25, please replace the paragraph beginning at line 1 with the following:

--A method of growing a p-type ZnO-based compound semiconductor according
to an embodiment of the invention of ~~claim 33~~ is characterized in that a ZnO-based
compound semiconductor is epitaxially grown by introducing a Group IA element as a p-
type dopant while introducing a Group VIIB element as a buffering agent in epitaxially
growing the ZnO-based compound semiconductor.--

Please replace the paragraph beginning at page 25, line 27 and ending at page
26, line 6 with the following:

--A method of growing a p-type ZnO-based compound semiconductor according
to an embodiment of the invention of ~~claim 36~~ is a method in which a ZnO-based
compound semiconductor is epitaxially grown by introducing a Group VB element as a

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p-type dopant while introducing a Group IIIB element as a buffering agent in epitaxially growing the ZnO-based compound semiconductor.--

On page 26, please replace the paragraph beginning at line 19 with the following:

--A semiconductor light emitting device according to the invention of claim ~~[[39]]~~
30 is a semiconductor light emitting device comprising a substrate, and a light emitting layer forming portion made of ZnO-based compound semiconductor layers disposed on the substrate and forming a light emitting layer with an n-type layer and a p-type layer, wherein the p-type layer contains an element capable of becoming an n-type dopant as a buffering agent.--

Please replace the paragraph beginning on page 26, line 27 and ending on page 27, line 8 with the following:

--A method of growing a compound semiconductor by vapor deposition according to an embodiment of the invention of claim 40 is characterized in that, when a p-type compound semiconductor layer is epitaxially grown by an MOCVD method, the p-type semiconductor layer is grown by alternately repeating a step of introducing a reaction gas for growing the compound semiconductor layer into a growth apparatus to grow a thin film of the semiconductor layer and a step of introducing a p-type dopant gas for carrying out a doping process.--

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Please replace the paragraph beginning at page 28, line 25 and ending on page 29, line 7 with the following:

--A method of growing crystals of an oxide compound semiconductor according to an embodiment of the invention of claim 45 is a method in which the single crystals of the oxide compound semiconductor are grown on a substrate by introducing an element constituting the compound semiconductor and oxygen in a plasma state, characterized in that the crystals of the oxide compound semiconductor are grown while removing or deviating charged particles generated in the plasma so that the charged particles will not be radiated directly onto the substrate.--

Please replace the paragraph beginning at page 29, line 25 and ending at page 30, line 7 with the following:

--An apparatus for growing crystals of an oxide compound semiconductor according to an embodiment of the invention of claim 47 has a main chamber, a substrate holder disposed in the main chamber, and a cell group disposed to be capable of radiating elements constituting the compound semiconductor towards a substrate held by the substrate holder, and a plasma source for radiating a plasma, wherein an electromagnetic field applying apparatus for applying an electric field and/or a magnetic field is disposed at least at a radiation outlet for radiating the plasma of the plasma source.--

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On page 30, please replace the paragraph beginning at line 8 with the following:

--A ZnO-based compound semiconductor light emitting device according to the invention of claim ~~[[48]]~~ 31 is a ZnO-based compound semiconductor light emitting device comprising a substrate and a light emitting layer forming portion that forms a light emitting layer by lamination of a ZnO-based compound semiconductor layer disposed on the substrate, wherein the ZnO-based compound semiconductor layer contains a C element. In other words, since an organic metal compound is used as a material for Zn, Zn and C are combined with O in a state in which some of Zn and C are in a bonded state because Zn and C have a large bonding energy, although the bonding of carbon and hydrogen in an organic metal is weak and liable to be cut off and hydrogen is liable to escape. As a result, some of Zn and C are in a bonded state, whereby the evaporation of Zn during the crystal growth can be prevented.--

Please replace the paragraph beginning on page 30, line 27 and ending at page 31, line 10 with the following:

--A method of manufacturing a ZnO-based compound semiconductor light emitting device according to an embodiment of the invention of claim 50 is characterized in that, in manufacturing a ZnO-based compound semiconductor light emitting device in which a ZnO-based compound semiconductor layer is laminated on a substrate to form a light emitting layer, the ZnO-based compound semiconductor is epitaxially grown on the substrate by radiating an organic metal compound of Zn as a Zn material of the ZnO-based compound onto a surface of the substrate for reaction on the substrate surface.--

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On page 31, please replace the paragraph beginning at line 19 with the following:

--A semiconductor laser according to the invention of claim ~~[[51]]~~ 33 comprises a substrate, a first cladding layer disposed on the substrate and made of a first conductivity type semiconductor, an active layer disposed on the first cladding layer, a second cladding layer disposed on the active layer and made of a second conductivity type semiconductor, and an electric current constriction layer disposed in the inside of or in the vicinity of the second cladding layer, wherein the electric current constriction layer is made of a ZnO-based compound semiconductor doped with a Group IA or Group VB element.--

On page 33, please replace the paragraph beginning at line 7 with the following:

--A semiconductor laser according to the invention of claim ~~[[54]]~~ 36 comprises a substrate, a first cladding layer disposed on the substrate and made of a first conductivity type semiconductor, an active layer disposed on the first cladding layer, a second cladding layer disposed on the active layer and made of a second conductivity type semiconductor, and an electric current constriction layer disposed in the inside of or in the vicinity of the second cladding layer and made of $\text{Mg}_z\text{Zn}_{1-z}\text{O}$ ($0 \leq z \leq 1$), wherein an etching stopping layer made of $\text{Cd}_s\text{Zn}_{1-s}\text{O}$ ($0 \leq s \leq 1$) or $\text{Be}_t\text{Zn}_{1-t}\text{O}$ ($0 \leq t \leq 1$) is disposed on the substrate side of the electric current constriction layer.--

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On page 34, please replace the paragraph beginning at line 5 with the following:

—A method of manufacturing a semiconductor laser according to an embodiment of the invention of claim 55 or 56 comprises the steps of growing a first conductivity type cladding layer, an active layer, and a second conductivity type lower cladding layer made of ZnO-based compound semiconductor on a substrate; growing an etching stopping layer made of $\text{Cd}_s\text{Zn}_{1-s}\text{O}$ ($0 \leq s \leq 1$) and an insulating or first conductivity type electric current constriction layer made of $\text{Mg}_z\text{Zn}_{1-z}\text{O}$ ($0 \leq z \leq 1$) on the second conductivity type lower cladding layer; etching the electric current constriction layer with an alkali solution to form an electric current injecting region; and growing a second conductivity type upper cladding layer made of a ZnO-based compound semiconductor. The electric current constriction layer may be grown in a similar manner by using $\text{Be}_t\text{Zn}_{1-t}\text{O}$ ($0 \leq t \leq 1$) as the etching stopping layer, and the electric current constriction layer may be etched with an acidic or alkaline etchant.—

On page 34, please replace the paragraph begging at line 22 with the following:

—An oxide compound semiconductor LED according to the invention of claim ~~[[57]]~~ 37 has a so-called MIS-type structure comprising an n-type layer made of an n-type ZnO-based compound semiconductor, an i-layer made of a semiinsulating ZnO-based compound semiconductor, and an electrically conductive layer disposed on a surface of the i-layer.—

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On page 35, please replace the paragraph beginning at line 21 with the following:

—A semiconductor light emitting device according to the invention of claim [[60]]
40 comprises a substrate and a light emitting layer forming portion disposed on the substrate and forming a light emitting layer by lamination of compound semiconductor layers having at least an n-type layer and a p-type layer, wherein the n-type layer is made of a ZnO-based compound semiconductor and the p-type layer is made of a GaN-based compound semiconductor.--